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# Energy storage: the building blocks toward a green grid

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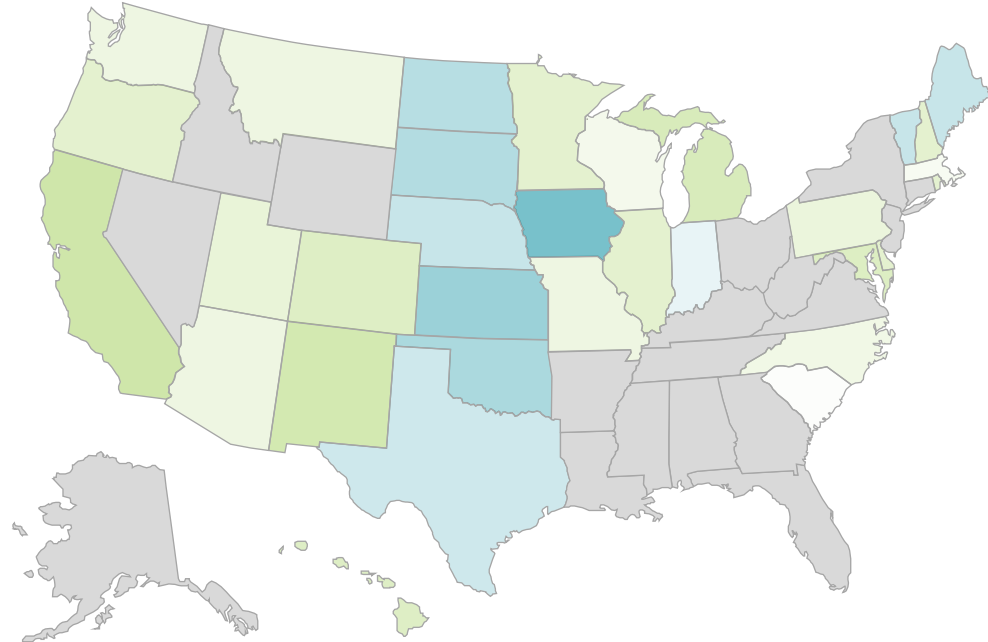
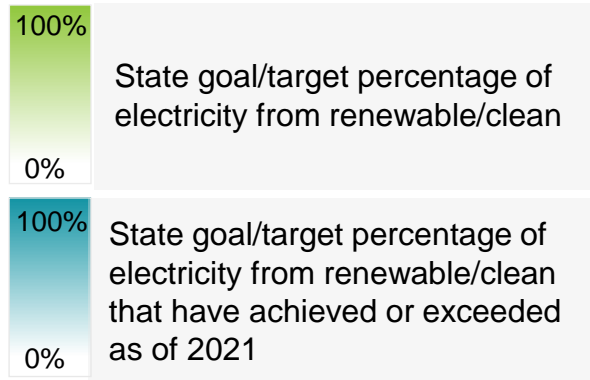


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# Renewable outlook: 2025

Majority of U.S. states have Renewable Portfolio Standards.

Map shows percentage of renewable achieved compared to the state standard or goal for the year indicated.



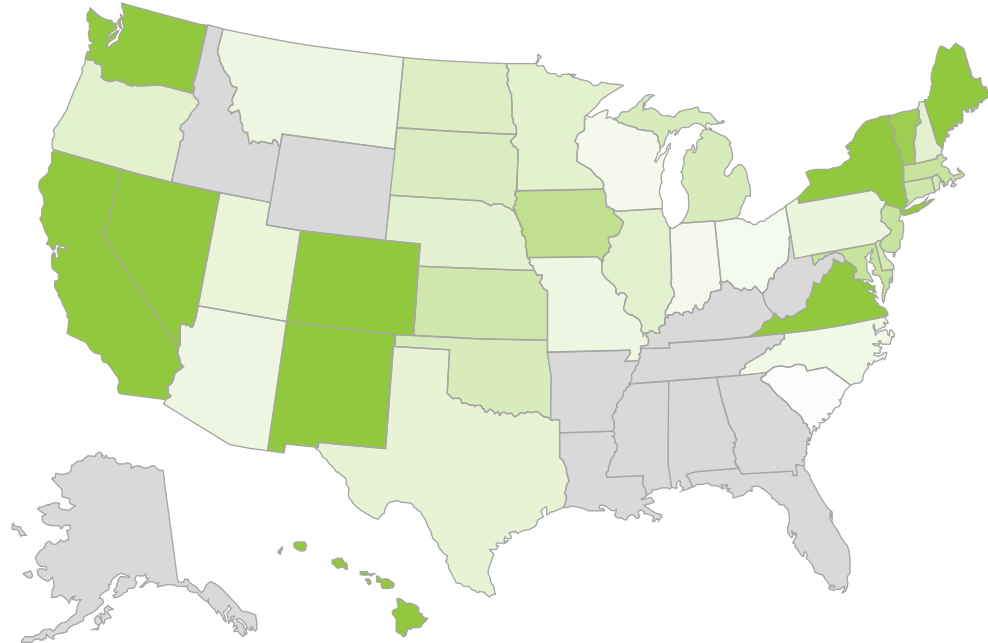
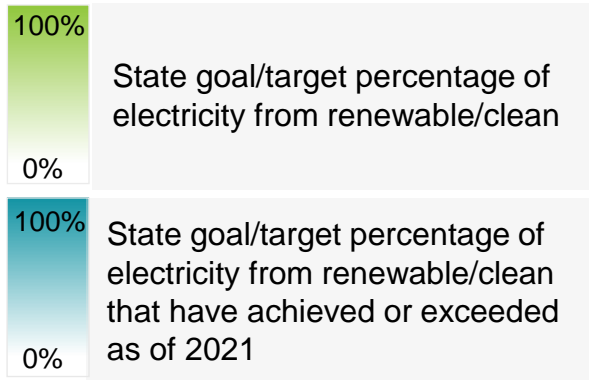
Source: [www.ncsl.org](http://www.ncsl.org)



# Renewable outlook: 2050

Majority of U.S. states have Renewable Portfolio Standards.

Map shows percentage of renewable achieved compared to the state standard or goal for the year indicated.



Source: [www.ncsl.org](http://www.ncsl.org)

# Energy storage

## Storage is defined as:

- An electric energy resource
- Capable of receiving electric energy from the grid and
- Storing it for later injection of electric energy back to the grid.

## A variety of technologies have this capability:

- Grid-scale battery systems
- Pumped hydropower
- Flywheels



# Benefits



## Grid flexibility

- Fast responses
- Improved reliability and efficiency
- Ancillary services



## Shift or reduce transmission congestion

- Lower transmission system costs



## Support renewables

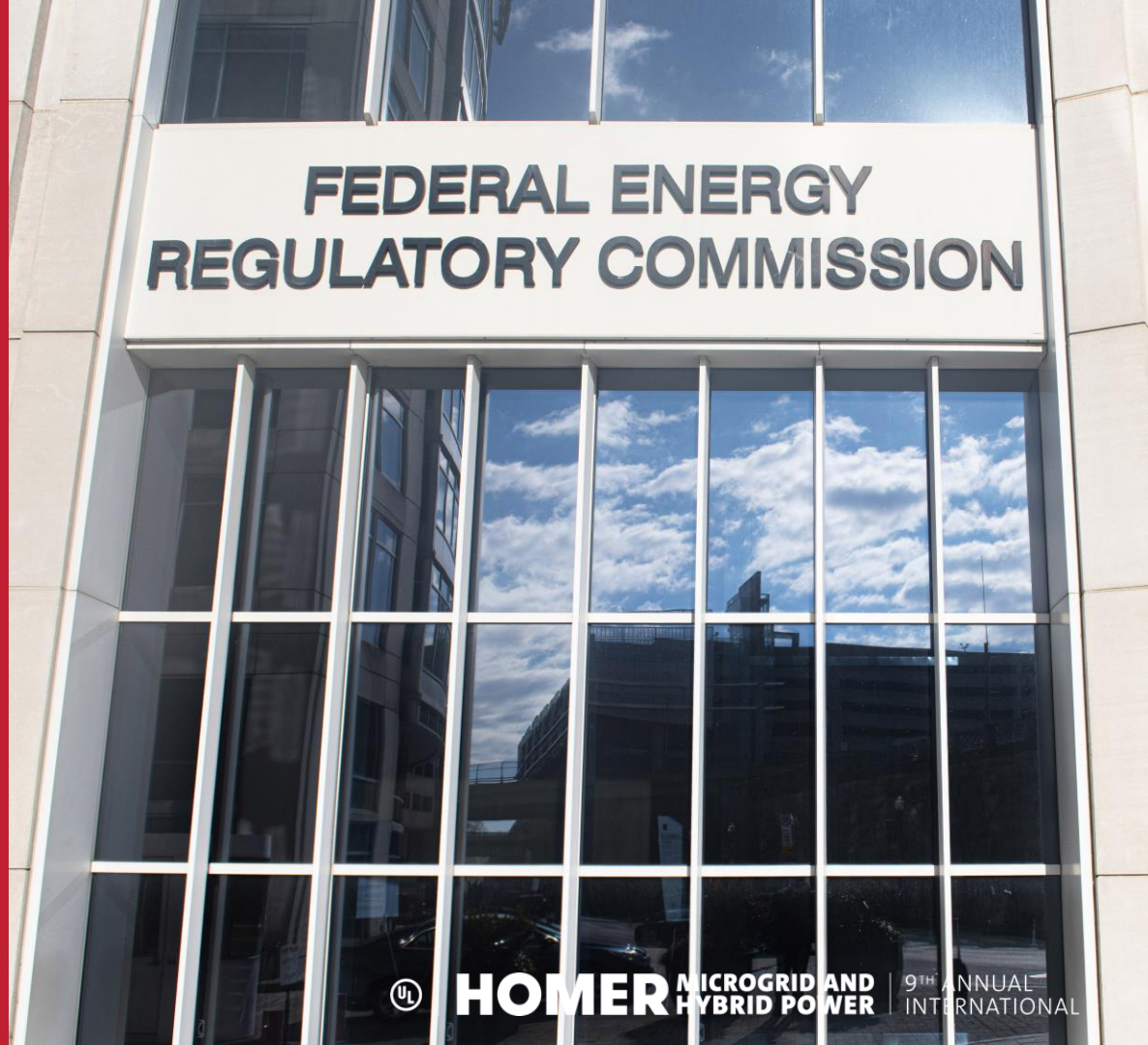
- Ability to store energy to offset intermittency

# Wholesale markets

U.S. FERC Order No. 841  
required independent system  
operators (ISO) to:

Establish market rules that  
facilitate their participation in  
regional transmission  
organizations (RTO) and  
ISOs, while recognizing the  
physical and operational  
characteristics of electric  
storage resources.

Photo courtesy of FERC



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# Energy market revenues



## **Storage resources 100 kW or larger will be eligible to:**

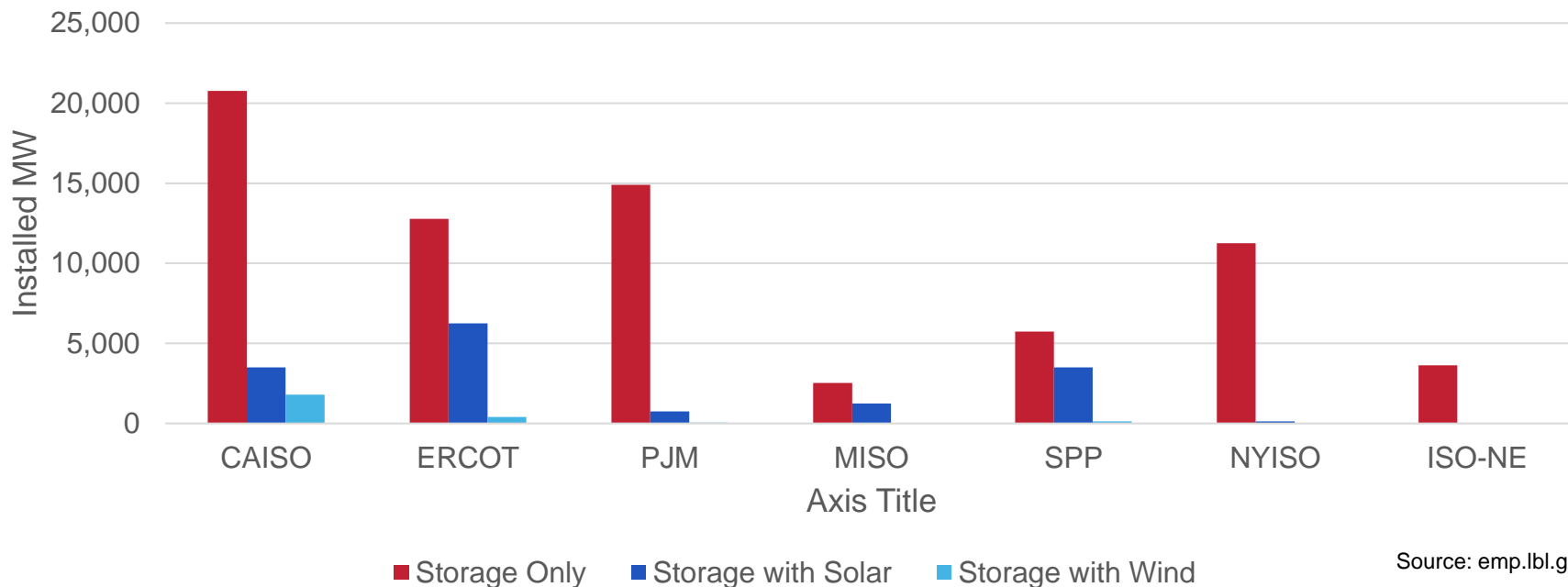
- Use the participation model to provide capacity, energy and ancillary services
- Receive make-whole payments
- Self-manage their state of charge (SOC)
- As a wholesale market seller or buyer, set the market clearing price
- Be exempt from transmission charges normally allocated to loads when dispatched by the RTO/ISO to provide ancillary services.

## **Definition of process:**

Energy market revenues come from the sale of electric energy from RTO/ISO markets to a storage resource that the electric storage resource then resells back to the RTO/ISO markets at the wholesale locational marginal price (LMP).



# Energy storage in interconnection queues through 2024 (as of the end of 2020)



# Energy storage state mandates (as of July 2021)

Total: 10,500 MW & 1,000 MWh

## By the end of 2025

Massachusetts: 1,000 MWh

## By the end of 2030

New York: 3,000 MW

New Jersey: 2,000 MW

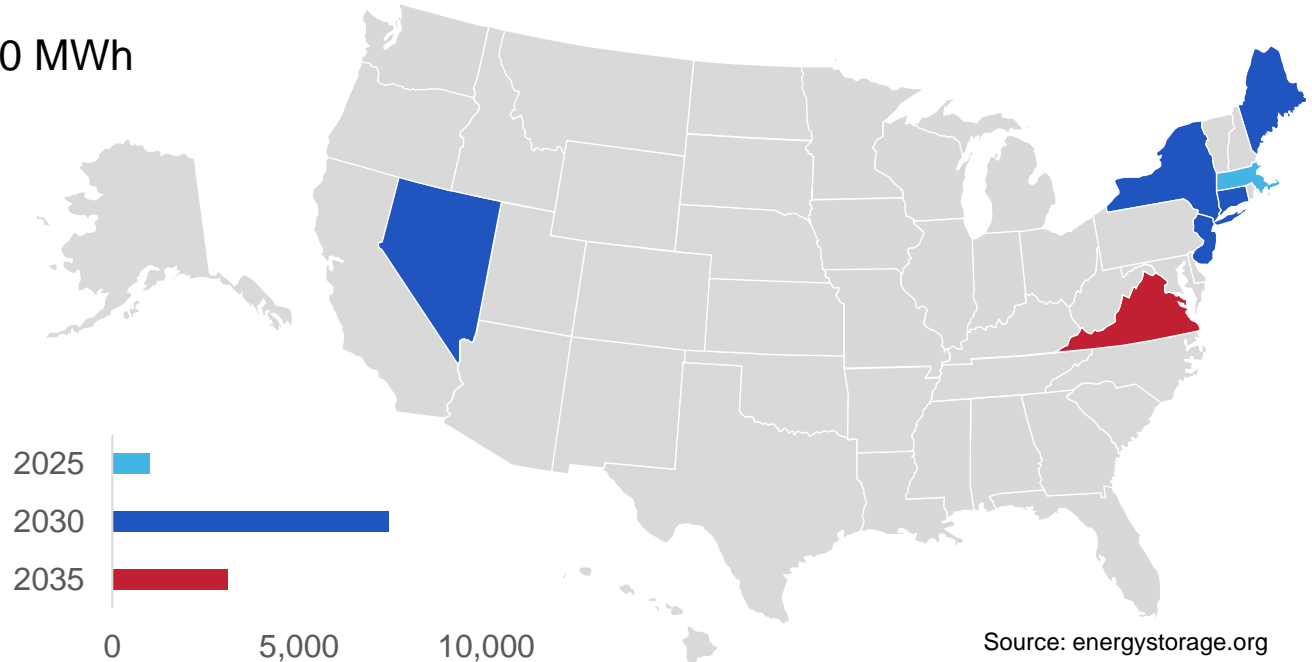
Nevada: 1,000 MW

Connecticut: 1,000 MW

Maine: 400 MW

## By the end of 2035

Virginia: 3,100 MW



Source: energystorage.org

# Thank you

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